The Use of LiDAR in Distribution and Transmission Vegetation Management – a white paper

Introduction

On March 5 and 6, 2014, 45 utility vegetation managers from throughout North America gathered in Fort Worth, Texas to share their experience with the use of LiDAR in the management of vegetation growing in and around their utility infrastructure. The managers that participated had over 700 years of combined experience in the electric utility industry. They represented 31 companies and together manage the vegetation on over 1,000,000 miles of distribution lines and transmission corridors that provide electricity to over 53,000,000 customers.

The framework for extensive discussions was laid by Mr. Samuel Harvey-Lavoie (Hydro Quebec) and Mr. Steve Narolski (BPA) who shared their respective experiences with the implementation of a LiDAR inventory on transmission lines. This white paper is the result of the subsequent discussions among the participants.

Application of LiDAR to Utility Vegetation Management

LiDAR is a remote sensing technology used increasingly by electric utilities. Much of the impetus behind the expanded use of LiDAR was a 2012 NERC Alert requiring transmission asset managers to verify facilities ratings on transmission lines of 200 kV or more. This created an opportunity for many utility vegetation managers who were able to include vegetation categories in the data acquisition process.

Benefits

Those with experience using LiDAR found it to be an effective tool. The volume and accuracy of the data resulting from the survey cannot be obtained from other inventory methodologies. The data obtained permitted better assessment of clearances in areas such as canyon crossings where ground and aerial patrols provided less definitive results. LiDAR provided exact identification and location of high risk off-ROW trees increasing efficiencies in the field. Those that used the technology were 100% confident in their compliance with FAC003, at least in the year in which the lines were flown.

It is acknowledged that the LiDAR data provides only a point-in-time snapshot. It does not fully satisfy the FAC inspection requirements. Ground and aerial patrols will need to continue. Verification still needs to be done with qualified personnel to obtain precise information such as the type or condition of the vegetation. Some users found, however, that the LiDAR data provided a means to conduct QA on ground inspections and they used that review to improve procedures leading to better results from the patrols.

Users identified other benefits experienced as being the ability to limit work to very specific sites where it is needed; added precision and valuable data to work specification; better definition and reclamation of the ROW edge; the ability to share data with other entities (e.g., municipal utilities, parks, etc.) and improved communications with landowners. They anticipate future use will include digitized work plans for their crews and the use of the data within predictive models.

Challenges

The primary challenge to implementing LiDAR inventories is the cost[1], which is often 7-8 times the cost of ground patrol. The cost of flying the line, however, is relatively uniform across the system while the cost of ground patrols is highly variable. Having a criterion-referenced approach that defines the targeted corridor and the intended use of the LiDAR data being collected is a critical first step. For example, in remote areas and hard to reach terrain, the cost of LiDAR is more easily justified. Regardless, data acquisition and interpretation is expensive so the opportunity to cost-share with engineering is critical to justifying the investment. Those with experience in multi-cycle inventories report LiDAR costs decline with subsequent flights.

Once the decision for data acquisition was made, the greatest challenge becomes dealing with false positives. Several utilities reported this to be a substantial issue with significant costs associated with their investigation. Like the cost of data acquisition, the number of false positives decline in subsequent flights.

Another significant challenge comes with the increased volume and accuracy of data. For instance, having a better accounting of off-ROW hazard trees can be a positive unless the resources (e.g., budget, crews, hardware/software and supervision) are not available to remedy the newly identified problem. The need to reallocate maintenance funds to take corrective action can be devastating to the sustainability of the existing routine program. On the other hand, not mitigating known hazards creates regulatory and liability exposure.

Summary

LiDAR is becoming a more popular tool used by utility vegetation managers. The richness of the data makes the LiDAR hard to compare with usual data acquisition, like ground and aerial patrols, because the volume and accuracy is significantly better. Cost of collecting data on vegetation is minimized when it is obtained as a bi-product of facility inspections.

On the initial flight, utilities are likely to experience an excessive number of false positives that must be investigated. This issue seems to resolve itself with experience and in subsequent surveys. Most anticipate periodic re-inventory of their facilities but not annual flights.

Once acquired, vegetation managers will be certain their vegetation is (or is not) compliant with FAC003. They may, like some, find that they have more issues than anticipated and will face the challenge of finding the resources to address the problem. They are also likely to find they have an excellent tool for dealing with resistant property owners and data that can be shared in a cooperative manner with the local municipalities and other entities.

While LiDAR provides a great amount of data with a variety of uses, the vegetation data has a very limited lifespan. Utilities will still need to perform ground and aerial patrols to stay compliant with regulations.

Advancements such as improved technologies and the use of drones may soon make LiDAR an even more frequently used tool for both distribution and transmission vegetation management. For now, the primary application of LiDAR will be on transmission lines. There is corresponding benefits to using LiDAR on the primary distribution system but the cost is currently considered by most to be prohibitive except in limited circumstances.

[1] Costs vary considerably from utility to utility but for order of magnitude comparisons, the cost of LiDAR was approximated at $800-900/mile compared to $100-150/mile for ground patrols.